METHOD AND APPARATUS FOR PACKAGING NON-WOVEN GARMENTS

TECHNICAL FIELD OF THE INVENTION

The present invention relates generally to the field of packaging, and more specifically to a method and apparatus for providing boxless and regularly shaped stackable packages of safety garments.

BACKGROUND OF THE INVENTION

Safety garments, such as disposable smocks, jumpsuits, gloves, shoe coverings, and hair coverings, are required apparel for the performance of many jobs. Some of the jobs requiring safety garments are performed in clean room environments, wherein the introduction of foreign matter must be minimalized. For example, technicians in certain sensitive medical fields dealing with infectious matter, aerospace researchers assembling interplanetary probes, and material scientists developing and manufacturing ultrapure materials all wear safety garments in clean room environments. The safety garments perform the dual function of protecting the wearer from the potentially hazardous materials he is working with as well as preventing unwanted matter from the wearer's person from contaminating his work product.

Safety garments are typically provided in lots containing a plurality of identical safety garments. These lots are typically provided in boxes made of a structural material such as cardboard, and are shaped as regularly sized rectangular blocks for ease of storage and handling. The safety garments are typically packed into these boxes, either by hand or by machine. One drawback of providing boxed safety garments is that particulate organic material may from the packaging process and/or from the box itself may adhere to the safety garment, thus partially defeating the purpose of the clean room environment. Further, the boxes themselves tend to attract vermin such as rodents and insects that enjoy consuming organic comestibles such as cardboard packaging. In addition to producing excess packaging particles when consuming the packaging material, such vermin also contribute even more particulate contamination in the form of carried dirt, shed hair, fecal waste matter, and the like. Thus, cardboard boxes are problematic for the transport and storage of safety garments intended for clean room use.

One partial solution has been to bag the safety garments in polymer bags or the like that do not contribute particulate contaminants and do not attract vermin. The problem with this approach is that the bags are inherently irregularly shaped and are thus not easily or conveniently stacked for storage and transport. Another partial solution has been to package the safety garments in boxes made of inorganic materials, such as plastics or metal that do not shed particulate contaminants and do not attract vermin. However, such packaging materials are inherently more expensive than traditional boxes and cannot be easily broken down for disposal, contributing even more expense to the enclosed products.

There thus remains a need for a need for an inexpensive packaging system that does not contribute particulate contamination, does not attract vermin and may be easily

stacked for storage and readily disposed of after it has served its purpose. The present invention addresses this need.

SUMMARY OF THE INVENTION

The present invention relates to a method and apparatus for compressively packaging safety garments to form stackable wrapped blocks. Compressible safety garments are placed into a rectangular parallelepiped compression chamber and an isostatic ram operationally connected to the compression chamber is inserted thereinto to apply a compression force to the garments. A vacuum pump fluidically connected to the compression chamber is actuated to reduce the air pressure in the compression chamber during the compression process, and the resulting compressed rectangular parallelepiped blocks are wrapped in flexible plastic wrapping material to yield wrapped rectangular parallelepiped blocks that may be stacked and stored for future use.

One object of the present invention is to provide an improved method and apparatus for packaging safety garments. Related objects and advantages of the present invention will be apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic illustration of a first embodiment apparatus for producing wrapped compressed blocks of safety garments of the present invention.

FIG. 2 is an enlarged partial view of the embodiment of FIG. 1.

FIG. 3 is a schematic view of safety garments being loaded into the compression chamber of FIG. 1.

FIG. 4 is a schematic view of safety garments being compressed in the apparatus of FIG. 1.

FIG. 5 is a schematic view of a compressed block of safety garments in the apparatus of FIG. 1.

FIG. 6 is a schematic view of the compressed block of safety garments of FIG. 5 being wrapped.

FIG. 7 is a perspective view of the wrapped block of safety garments as wrapped in FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

For the purposes of promoting an understanding of the principles of the invention and presenting its currently understood best mode of operation, reference will now be made to the embodiments illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, with such alterations and further modifications in the illustrated device and such further applications of the principles of the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

FIGs. 1-7 schematically illustrate a first embodiment of the present invention, a packaging apparatus 10 and method for the containerless or boxless packaging of non-woven garments 12, such as smocks or coveralls made from spunbond/melt blown/melt blown/spunbond (SMMS) material and the like. The nonwoven garments are characterized by an associated loose density. The packaging apparatus 10 includes a cavity or chamber 14 for compressing a plurality of safety garments 12 placed thereinto. The chamber 14 preferably includes a rectangular base 16 with four generally planar walls 18 extending perpendicularly therefrom to define an orthorhombic parallelepiped enclosure 14. In some preferred embodiments, the base 16 is a square. The chamber 14 more preferably defines a volume from about 4500 cubic inches to about 8100 cubic inches. In some preferred embodiments, the chamber 14 is a cube.

The chamber 14 is sized to receive an isostatic ram member 20, shown in detail in FIG. 2. The isostatic ram member 20 is operationally connected to the chamber 14 and is able to move into the chamber 14 to provide a compressive force to the interior of

the chamber 14 sufficient to compress nonwoven safety garments 12 loaded into the chamber 14 and remove substantially all of the entrapped air therefrom. Preferably, a ram 20 pressure of about 80 PSI is sufficient to compress the garments 12 and facilitate removal of most or all of the entrapped air from the chamber 14. Also preferably, there is sufficient gap between the ram member 20 and the chamber walls 18 to allow air to escape as the ram member 20 is introduced into the chamber 14.

The apparatus 10 preferably further includes a vacuum system 26 for pulling a partial vacuum on the chamber 14 during the compression operation. The vacuum system 26 includes a vacuum pump 28 fluidically connected to the chamber 14 such that actuation of the vacuum pump 28 reduces the air pressure in the chamber 14. The vacuum system 26 further includes an air conduit 30 pneumatically or fluidically connected to the chamber 14 for at least partially removing the air therefrom, and also an enclosure defining a vacuum chamber 32 within which the chamber 14 is disposed. The vacuum chamber 32 is shown herein schematically, and may be of any convenient configuration sufficient to allow the generation of a partial vacuum within the compression chamber 14.

The apparatus 10 further includes means for wrapping a compressed block 36 with a flexible nonshedding wrapping material 38 to yield an substantially orthorhombic parallelepiped-shaped block of compressed safety garments 40, such as a polymer sheet, plastic film, or the like. Such means is illustrated schematically herein, and may comprise any convenient automated wrapping technology in the art. The polymer wrapping material 38 is preferably a polymer material capable of sustaining a pressure differential (i.e., vacuum wrapping a bundle of compressed garments 12) and is more preferably polyethylene, polypropylene, polyester (such as MYLAR®) or the like. The polymer wrapping material 38 is preferably of sufficient thickness to retard gas leakage

thereacross. In the case of a polyethylene wrapping material 38, the preferred sheet thickness is about 4 mils. However, any convenient flexible wrapping material 38 of sufficient thickness to wrap a compressed block 36 sufficiently to retain its substantially orthorhombic parallelepiped shape may be selected. Moreover, by wrapping the block 36 in additional layers, thinner and more deformable wrapping material 38 may be suitable.

In operation, a number of compressible safety garments 12 are preferably folded and stacked, and then placed into the chamber 14. Preferably, between about 10 and about 15 pounds of safety garments 12 are placed into the chamber 14 at once. The chamber is preferably sized to accept the stack of safety garments 12 with a minimum amount of excess volume. The interior of the chamber 14 is preferably lined with a polymer or plastic wrapping material 38, such that the safety garments 12 are placed into the wrapping material 38 in the chamber 14. Alternately, the wrapping material 38 may be applied to the compressed mass 36 after the removal of the compressed mass 36 from the chamber 14.

Preferably, a partial vacuum is then produced within the chamber 14 and the safety garments 14 are then isostatically pressed to compact their volume and remove entrapped air. However, the compaction process does not necessarily require the presence of a partial vacuum and may be performed at standard air pressure. Preferably, the safety garments are compacted to a density of between about 2 and about 5 times their associated loose density, and more preferably to about 3 times their loose density. Preferably, a force of between about 50 and about 120 PSI is sufficient to achieve such compression. Typically, the density of a compressed mass 36 is about 0.004 pounds per cubic inch.

The wrapping material 38 is then sealed (the sealing process is preferably but not necessarily performed under a partial vacuum) and the resulting compressed block 36 is removed from the chamber 14. Preferably, the block 36 is again wrapped with wrapping material 38 (i.e., the compressed block of garments 36 is double wrapped) and the outer wrapping 38 is then sealed (preferably heat sealed); alternately, the block 36 may be heat sealed or otherwise sealed after its initial compression. More preferably, the second application of wrapping material 38 is in the form of a gusset to assist in the retention of the preferred block shape. The resultant package 40 has the shape of an orthorhombic (preferably rectangular) parallelepiped and retains that shape during shipping and storage. In one preferred embodiment, the package 40 has dimensions of about 16 x 14 x 12 inches and has a mass of about 11 pounds.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character. It is understood that the embodiments have been shown and described in the foregoing specification in satisfaction of the best mode and enablement requirements. It is understood that one of ordinary skill in the art could readily make a nigh-infinite number of insubstantial changes and modifications to the above-described embodiments and that it would be impractical to attempt to describe all such embodiment variations in the present specification. Accordingly, it is understood that all changes and modifications that come within the spirit of the invention are desired to be protected.